CLAIMS

1. An anatomically-compatible and physiologically-compatible *in vivo* device for improving diastolic function of either the left or right ventricle of the heart, comprising:

at least one air-impermeable sheet that is capable of being operatively connected to the external ventricular surface of the heart by means of one or more connecting elements, wherein said at least one sheet is curved or angled, such that a hollow space exists between said sheet and the imaginary surface containing the perimeter of said sheet,

such that when said air-impermeable sheet is operatively connected to the external ventricular surface of the heart, a closed empty space is created between the lower surface of said sheet and said external ventricular surface,

such that said at least one air-impermeable sheet is capable of creating a sub-atmospheric pressure within said closed empty space as a consequence of changes in the volume of said space during the course of the cardiac cycle, thereby exerting an outward and normally directed force on the external ventricular surface of the heart to which said air-impermeable sheet may be connected by means of said one or more connecting elements.

2. The device according to claim 1, wherein the air-impermeable sheet comprises a curved sheet of a biocompatible polymeric material.

3. The device according to claim 1, further comprising at least one rigidity-determining element.

4. The device according to claim 3, wherein the air-impermeable sheet is in the form of a convex shaped rigid, semi-rigid or elastic element, in which are present a plurality of laterally-disposed rigidity-determining elements.

5. The device according to claim 1, wherein said device further comprises a one-way valve inserted into the air-permeable sheet.

6. A method for improving diastolic function of the left and/or right ventricles of the heart, comprising

attaching an air-impermeable sheet to the external surface of the left ventricle, right ventricle or both ventricles,

ascertaining that air-tight sealing of the peripheral margin of said sheet to the external ventricular wall has occurred, and optionally, as required,

draining fluid and solid debris from the space formed between one surface of said sheet and the external ventricular wall through drainage means fitted in said sheet to a region located on the other side of said sheet.

7. The method according to claim 6, wherein the drainage means comprises a one-way valve connected to one or more tubes.

8. The method according to claim 6, wherein the air-impermeable sheet is attached to the external ventricular wall during the end diastolic period of the cardiac cycle.

9. The method according to claim 6, wherein the air-impermeable sheet is attached to the external ventricular surface by means of one or more attachment means selected

from the group consisting of transmural biocompatible pins, other non-transmural pins, biocompatible needles, biocompatible spikes, biocompatible helical coil screws, biocompatible clamps, biocompatible tubes biocompatible glue and surgical sutures.

10. The method according to claim 6, wherein the air-impermeable sheet is attached to the external ventricular surface by means of a fabric patch girdle.

11. The method according to claim 6, wherein the air-impermeable sheet is constructed such that the maximal value for the normally-outward expansive pressure exerted on at least one part of the external ventricular wall is in a range of about 5 mm Hg to about 40 mm Hg.

12. The method according to claim 6, wherein the ventricle to be treated is the left ventricle.